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DOCKET NO. 92-C-074D3 (STMI01-00024) PATENT
Customer No. 30425

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	Frank Randolph Bryant
U.S. Serial No.	:	09/858,397
Filed	:	May 16, 2001
For	:	TRANSISTOR STRUCTURE AND METHOD FOR MAKING SAME
Group No.	:	2822
Examiner	:	K.B. Duong

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MAIL STOP APPEAL BRIEF - PATENTS
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Sir:

APPELLANT'S BRIEF ON APPEAL

This Brief is submitted in triplicate on behalf of Appellants for the application identified above. A check is enclosed for the $320.00 fee for filing a Brief on Appeal. Please charge any additional necessary fees to Deposit Account No. 50-0208.

REAL PARTY IN INTEREST

The real party in interest for this appeal is the assignee of the application, STMICRO-ELECTRONICS, INC. (f/k/a SGS-THOMSON MICROELECTRONICS, INC.).

RELATED APPEALS AND INTERFERENCES

An appeal is pending in U.S. Patent Application Serial No. 08/159,461, the parent of the subject application. There are no interferences related to the present application which are currently pending.

STATUS OF CLAIMS

Claims 17–23, 25 and 46–59 are pending in the present application. Claims 17–23, 25 and 58–59 have been withdrawn from consideration by the Examiner following a restriction requirement, but not canceled. Claims 46 and 48 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,422,291 to *Clementi et al.* Claims 47 and 56–57 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Clementi et al.* Claims 46–55 were rejected under the judicially created doctrine of obviousness-type (nonstatutory) double patenting grounded in 35 U.S.C. § 101 over U.S. Patent No. 5,710,453 to *Bryant.* The restriction of claims 17–23, 25 and 58–59, the rejection of claims 46–55, and the refusal to enter the amendment after final are appealed.

STATUS OF AMENDMENTS

An amendment to claim 46 was submitted in the Applicant's response to the final Office Action mailed April 17, 2003. An Advisory Action mailed September 29, 2003 refused entry of that

amendment on the grounds that the amendment raised new issues requiring further search and consideration.

SUMMARY OF THE INVENTION

The present invention relates to formation of a gate structure within an integrated circuit. In the present invention, a gate oxide, nitride and polysilicon stack is patterned to form a gate electrode, which is then reoxidized.

ISSUES ON APPEAL

Claims 17–23, 25 and 58–59 were restricted from claims 46–55. Claims 46 and 48 were rejected under 35 U.S.C. § 102(e) as being anticipated by *Clementi et al.* Claims 47 and 56–57 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Clementi et al.* Claims 46–55 were rejected under the judicially created doctrine of obviousness-type (nonstatutory) double patenting grounded in 35 U.S.C. § 101 over *Bryant.* Applicant's amendment after final was refused entry as raising new issues requiring further search and consideration. The issues on appeal are:

1. whether the refusal to enter Applicant's amendment to claim 46 after the final Office Action was proper;

2. whether 17–23, 25 and 58–59 were properly restricted from claims 46–55;

3. whether claims 46 and 48 were properly rejected under 35 U.S.C. § 102(e) as being anticipated by *Clementi et al*;

4. whether claims 47 and 56–57 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Clementi et al*; and

5. whether claims 46–55 were rejected under the judicially created doctrine of obviousness-type (nonstatutory) double patenting grounded in 35 U.S.C. § 101 over *Bryant*.

GROUPING OF CLAIMS

Claims 17–23, 25 and 45–59 are pending in the present application. Claims 17–23, 25 and 48–59 were restricted from claims 46–55. Claims 46 and 48 were rejected under 35 U.S.C. § 102(e) as being anticipated by *Clementi et al*. Claims 47 and 56–57 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Clementi et al*. Claims 46–55 were rejected under the judicially created doctrine of obviousness-type (nonstatutory) double patenting grounded in 35 U.S.C. § 101 over *Bryant*. Applicant's amendment to claim 46 after the final Office Action was refused entry. For purposes of this appeal, the pending claims will be grouped together as follows:

Group A – claim 46;

Group B – claims 17–23, 25 and 46–59 (all pending claims);

Group C – claims 46–57;

Group D – claim 47;

Group E – claim 48;

Group F – claim 49;

Group G – claim 50;

Group H – claim 51;

Group I – claim 54;

Group J – claim 55;

Group K – claim 56;

Group L – claim 57; and

Group M – claims 46–55.

Groups A–M stand or fall independently. Patentability of the claims within each group is argued separately below.

ARGUMENT

Group A (Claim 46)

Claim 46 of Group A was amended after the final Office Action, which amendment was refused entry on that grounds that the amendment raised new issues requiring further search and consideration. This claim is properly considered separately from the claims of Groups B–M since a different issue is involved than with the claims of the remaining groups, and since a decision with respect to the claim of Group A may obviate the need for consideration of the claims of Groups C–M.

As originally filed, claim 46 recited "a nitride layer on the gate oxide layer." In response to the first Office Action, Applicant argued that the claim term "on" precluded any intervening material between the nitride layer and the gate oxide layer, as compared to the term "over," under which an

intervening layer would fall within the scope of the claim. Applicant thus argued that the nitride layer must directly contact the gate oxide layer.

The final Office Action adopted–or at least expressed for the first time–an interpretation of the term "on" as merely requiring a "'position in close proximity' with respect to something," citing a page from Mirriam-Webster's Collegiate Dictionary, Tenth Edition (purportedly attached to the final Office Action, but not so attached to the copy received by Applicant). In response, Applicant amended claim 46 to recite "a nitride layer on and directly contacting the gate oxide layer" (added text indicated by underlining). The amendment after the final Office Action, therefore, merely explicitly recited a claim feature that had previously been argued as intrinsic to the claim language employed. The claim amendment accordingly does NOT raise any new issue, and entry of the amendment should not have been denied.

Group B (Claims 17–23, 25 and 46–59)

Claims 17–23, 25 and 46–59 of Group B were subject to a restriction requirement. These claims are properly grouped together and considered separately from the claims of Groups A and C–M since a different issue is involved than with the claims of the remaining groups.

A restriction requirement was entered against claims 17–23, 25 and 58–59 and claims 46–57 based on the assertion that the product as claimed can be made by another and materially different process since:

> [C]hemical vapor deposition (CVD) and thermal oxidation are two distinctively well known techniques of forming an oxide layer which can alternatively be used to form the oxide layer over the gate structure of the instant invention.

Paper No. 12, page 5. However, the standard for restriction is not merely whether different (but interchangeable) processes for forming an oxide layer, but whether the processes are patentably distinct. The record contains no evidence that chemical vapor deposition and thermal oxidation produce physically or chemically different oxides, or that the processes may not be readily substituted for each other.

The final Office Action asserts:

> [C]hemical vapor deposition (CVD) and thermal oxidation are two distinctly well known techniques of forming an oxide layer which can be alternatively used to form the oxide layer over the gate structure of the instant invention.

Paper No. 12, page 5. First, the standard is a material or patentable difference, not merely any difference, which is not established by the record or addressed by any Office Action. Second, the fact that both processes are "well known technique of forming an oxide layer" and "can alternatively be used to form the oxide layer" essentially concedes that the processes are NOT materially different. Accordingly, the restriction requirement has no basis in the record and is arbitrary and capricious.

Group C (Claims 46–57)

Claims 46 and 48 of Group C were rejected under 35 U.S.C. § 102(e) as being anticipated by *Clementi et al.* Claims 47 and 49–57 of Group C were rejected under 35 U.S.C. § 103(a) as obvious over *Clementi et al.* These claims are properly grouped together and considered separately

from the claims of Groups A–B and D–M since a different issue is involved than with the claims of Groups A–B and M, and since a decision with respect to the claims of Group C may obviate the need for consideration of the claims of Groups D–L.

Independent claim 46 of Group C recites a nitride layer on the gate oxide layer. Such a feature is not depicted or described in the cited reference. *Clementi et al* depicts in Figure 4-bis and describes in the associated text a gate structure including a gate oxide 4, a polysilicon floating gate 5 on the gate oxide 4, and a composite O-N-RTN layer 6 including nitridized polysilicon 6a, silicon nitride 6b, and oxidized silicon nitride 6c on the polysilicon floating gate 5:

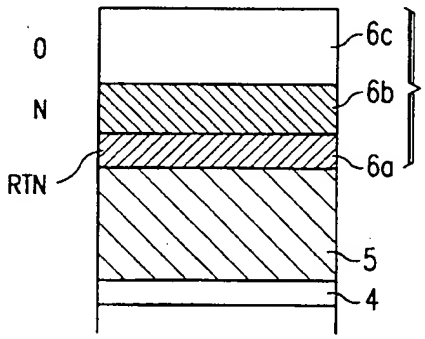

FIG. 4–bis

Clementi et al, Figure 4-bis, column 5, lines 8–44. Thus, *Clementi et al* depicts and describes an nitride 6b on a nitridized polysilicon 6a, which is on polysilicon floating gate 5, which in turn is on gate oxide 4. *Clementi et al* does not depict or describe nitride 6b as being on gate oxide 4, depicting and describing instead nitride 6b over the gate oxide 4.

The Examiner cites one of several (apparently) several definitions within Merriam-Webster's Collegiate Dictionary as support for an interpretation of "on" as merely requiring a "position in close proximity." Such an interpretation is contrary to the ordinary meaning of the term within the relevant art, the meaning ascribed to the term within the specification, and the prosecution history estoppel created by Applicant's arguments. In addition, Applicant attempted to amend the claim to explicitly recite direct contact between the nitride and oxide layers. Taken in light of the refusal to enter that amendment, the interpretation and associated rejection–which are unsupported by the record–are both arbitrary and capricious.

Group D (Claim 47)

Claim 47 of Group D was rejected under 35 U.S.C. § 103(a) as obvious over *Clementi et al.* This claim is properly considered separately from the claims of Groups A–C and E–M since a different issue is involved than with the claims of Groups A–B and M, and since the claim of Group D recites a limitation patentably distinguishing the claimed invention over the cited prior art which is not found in the claims of Groups C and E–L.

Claim 47 of Group D recites that the nitride layer is between 10 and 50 Angstroms (Å) thick. Such a feature is not found in the cited reference. The final Office Action asserts that dimensional parameters fail to recite patentable subject matter. That statement is not an accurate statement of the current law. Obviousness inquiries, due to their highly fact-specific and fact-intensive nature, have been deemed not to be amenable to *per se* rules such as that expressed in the Office Action. *In re*

Ochiai, 71 F.3d 1565, 1569 (Fed. Cir. 1995). Mere citation of a *per se* rule regarding what constitutes obvious modifications, without identifying a motivation or incentive for the proposed modification, does not establish a *prima facie* case of obviousness.

Group E (Claim 48)

Claim 48 of Group E was rejected under 35 U.S.C. § 102(e) as being anticipated by *Clementi et al.* This claim is properly considered separately from the claims of Groups A–D and F–M since a different issue is involved than with the claims of Groups A–B and M, and since the claim of Group E recites a limitation patentably distinguishing the claimed invention over the cited prior art which is not found in the claims of Groups C–D and F–L.

Claim 48 of Group E recites that the nitride is formed by deposition over the gate oxide layer. Such a feature is not found in the cited reference. In *Clementi et al*, nitridized polysilicon is thermally grown. In connection with the restriction requirement, the Office Action asserts that thermal growth of layers is materially (i.e., patentably) different from deposition. Accordingly, claim 48 is patentably different from the subject matter disclosed in *Clementi et al.*

Group F (Claim 49)

Claim 49 of Group F was rejected under 35 U.S.C. § 103(a) as obvious over *Clementi et al.* This claim is properly considered separately from the claims of Groups A–E and G–M since a different issue is involved than with the claims of Groups A–B and M, and since the claim of Group

F recites a limitation patentably distinguishing the claimed invention over the cited prior art which is not found in the claims of Groups C–E and G–L.

Claim 49 of Group F recites that the nitride layer is formed by nitrogen implantation and annealing. Such a feature is not found in the cited reference. Moreover, due to the resulting non-uniform distribution of nitrogen, the resulting nitride will have a different structure than thermally grown or deposited nitride.

Group G (Claim 50)

Claim 50 of Group G was rejected under 35 U.S.C. § 103(a) as obvious over *Clementi et al.* This claim is properly considered separately from the claims of Groups A–F and H–M since a different issue is involved than with the claims of Groups A–B and M, and since the claim of Group G recites a limitation patentably distinguishing the claimed invention over the cited prior art which is not found in the claims of Groups C–F and H–L.

Claim 50 of Group G recites an uplift in portions of the nitride proximate a peripheral edge, caused by reoxidation. Such a feature is not found in the cited reference.

Group H (Claim 51)

Claim 51 of Group H was rejected under 35 U.S.C. § 103(a) as obvious over *Clementi et al.* This claim is properly considered separately from the claims of Groups A–G and I–M since a different issue is involved than with the claims of Groups A–B and M, and since the claim of Group

H recites a limitation patentably distinguishing the claimed invention over the cited prior art which is not found in the claims of Groups C–G and I–L.

Claim 51 of Group H recites an indentation in a surface of the substrate resulting from reoxidation of the gate structure. Such a feature is not found in the cited reference.

Group I (Claim 54)

Claim 54 of Group I was rejected under 35 U.S.C. § 103(a) as obvious over *Clementi et al.* This claim is properly considered separately from the claims of Groups A–H and J–M since a different issue is involved than with the claims of Groups A–B and M, and since the claim of Group I recites a limitation patentably distinguishing the claimed invention over the cited prior art which is not found in the claims of Groups C–H and J–L.

Claim 54 of Group I recites recites that the source and drain regions are implanted prior to reoxidation. Such a feature is not found in the cited reference.

Group J (Claim 55)

Claim 55 of Group J was rejected under 35 U.S.C. § 103(a) as obvious over *Clementi et al.* This claim is properly considered separately from the claims of Groups A–I and K–M since a different issue is involved than with the claims of Groups A–B and M, and since the claim of Group K recites a limitation patentably distinguishing the claimed invention over the cited prior art which is not found in the claims of Groups C–I and K–L.

Claim 55 of Group J recites that the source and drain regions are implanted after reoxidation. Such a feature is not found in the cited reference.

Group K (Claim 56)

Claim 56 of Group K was rejected under 35 U.S.C. § 103(a) as obvious over *Clementi et al.* This claim is properly considered separately from the claims of Groups A–J and L–M since a different issue is involved than with the claims of Groups A–B and M, and since the claim of Group K recites a limitation patentably distinguishing the claimed invention over the cited prior art which is not found in the claims of Groups C–J and L.

Claim 56 of Group K recites that the channel length is not greater than 0.8 microns. Such a feature is not found in the cited reference.

Group L (Claim 57)

Claim 57 of Group L was rejected under 35 U.S.C. § 103(a) as obvious over *Clementi et al.* This claim is properly considered separately from the claims of Groups A–K and M since a different issue is involved than with the claims of Groups A–B and M, and since the claim of Group L recites a limitation patentably distinguishing the claimed invention over the cited prior art which is not found in the claims of Groups C–K.

Claim 57 of Group L recites that the gate oxide is not greater than 200 Angstroms thick. Such a feature is not found in the cited reference.

Group M (Claims 46–55)

Claims 46–55 of Group M was rejected for obviousness-type double patenting over *Braynt*. These claims are properly grouped together considered separately from the claims of Groups A–L since a different issue is involved than with the claims of Groups A–L.

Like the application on which U.S. 5,710,453 to *Bryant* issued, the present application is a division of U.S. Application Serial No. 08/159,461, in which restriction requirements were entered on September 29, 1994 and December 20, 1994. Since the subject claims were restricted in the parent application, double patenting does not apply.

CONCLUSION

The amendment after the final Office Action did not raise a new issue. Therefore, the refusal to enter the amendment to the claim of Group A is improper. The record fails to establish the existence of a process materially different from the process recited in claims 17–23, 25 and 58–59 for making the product of claims 46–57. Therefore, the restriction requirement entered against the claims of Group B. The sole cited reference fails to depict or describe all features of the invention claimed in Groups C–L. Therefore, the rejections under 35 U.S.C. §§ 102 and 103 are improper. A restriction requirement was entered in the parent application. Therefore the rejection of the calims of Group M for double patenting is improper. Applicant respectfully requests that the Board of Appeals reverse the decisions of the Examiner below (a) refusing entry of the amendment after final, (b) entering and maintaining a restriction requirement, and (c) rejecting pending claims 46–57 in the application.

Respectfully submitted,

DAVIS MUNCK, P.C.

Date: 10-28-03

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APPENDIX TO APPELLANT'S BRIEF ON APPEAL
PENDING CLAIMS ON APPEAL

Claims 1–16 (Canceled).

17. (Withdrawn) A method of fabricating a portion of a semiconductor device comprising:

forming a gate structure on a substrate by:

depositing an insulating oxide layer on the substrate;

depositing a nitride layer on the oxide layer; and

depositing a polysilicon layer on the nitride layer; and

reoxidizing the gate structure to form a layer of oxide over the gate structure.

18. (Withdrawn) The method of claim 17, wherein the depositing step includes depositing the nitride layer on the insulating oxide layer to a thickness from about 10 Å to about 50 Å.

19. (Withdrawn) The method of claim 17, wherein the reoxidizing step includes reoxidizing the gate structure to form an oxide layer from about 25 Å to about 500 Å thick.

20. (Withdrawn) The method of claim 17, further comprising:

patterning the gate structure by selectively etching away portions of the insulating oxide, nitride and polysilicon layers to expose a portion of the substrate and form a peripheral edge around the gate structure; and

exposing the substrate to an oxidizing ambient during reoxidation to oxidize the exposed portion of the substrate.

21. (Withdrawn) The method of claim 20, wherein the reoxidation causes an uplift in a peripheral portion of the nitride layer.

22. (Withdrawn) The method of claim 20, wherein the reoxidation causes an indentation in the substrate near the peripheral edge of the gate structure.

23. (Withdrawn) The method of claim 17, further comprising:

prior to the reoxidizing step, forming source and drain regions in the substrate.

Claim 24 (Canceled).

25. (Withdrawn) A method for fabricating a portion of a semiconductor device, comprising:

forming an oxide gate layer on a surface of a substrate;

forming a nitride layer on the oxide gate layer by depositing the nitride layer on the oxide gate layer;

forming a polysilicon layer on the nitride layer;

patterning the polysilicon and nitride layers to form a gate structure; and

reoxidizing the gate structure to form a layer of oxide over the gate structure and on sidewalls of the gate structure.

Claims 26–45 (Canceled).

46. An integrated circuit device comprising:

a substrate;

a gate structure, wherein the gate structure includes:

a gate oxide layer on the substrate,

a nitride layer on the gate oxide layer, and

a polysilicon layer over the nitride layer;

a channel region under the gate structure; and

source/drain regions in the substrate adjacent the channel region.

47. The integrated circuit device of claim 46, wherein the nitride layer is from about 10 Å to about 50 Å thick.

48. The integrated circuit device of claim 46, wherein the nitride layer is deposited over said gate oxide layer.

49. The integrated circuit device of claim 46, wherein the nitride layer is formed by nitrogen implantation to form an implanted area and by annealing of the implanted area.

50. The integrated circuit device of claim 46, wherein the gate structure has a peripheral edge and further including an uplift in portions of the nitride layer proximate the peripheral edge of the gate structure, the uplift caused by reoxidation of the gate structure, wherein asperities are absent from the polysilicon layer.

51. The integrated circuit device of claim 46, wherein the substrate has a surface and further including an indentation in the surface of the substrate located proximate to the peripheral edge of the gate structure, the indentation resulting from reoxidation of the gate structure.

52. The integrated circuit device of claim 46 further wherein the gate structure includes sidewall spacers located on each edge of the gate structure and lightly doped drain regions in the substrate below the sidewalls spacers.

53. The integrated circuit device of claim 46, wherein the substrate is a p-type substrate and wherein the source/drain regions are formed by implanting n-type impurities in the p-type substrate.

54. The integrated circuit device of claim 51, wherein the source/drain regions are implanted prior to reoxidation.

55. The integrated circuit device of claim 53, wherein the source/drain regions are implanted after reoxidation.

56. The integrated circuit device of claim 46, wherein the channel region has a length not greater than 0.8 μm.

57. The integrated circuit device of claim 46, wherein the gate oxide layer is not greater than 200 Å thick.

58. (Withdrawn) The method of claim 23, wherein a channel region beneath the gate structure between the source/drain regions has a length not greater than 0.8 μm.

59. (Withdrawn) The method of claim 25, further comprising:

forming the oxide gate layer to a thickness not greater than 200 Å.